

Stock Market Simulation and Analysis

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Abstract

Among numerous investment strategies in the stock market, this stock market simulation focused on the conservative strategy of John Bogle, which states that stock trading is a losing game and investment in index funds is a more profitable strategy. The theory was tested by comparing the performance of an actively managed portfolio in an online simulator to index funds approximating the market. The outcome was a draw, with both active and passive strategies resulting in depreciation over a down market.

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Chapter One: Introduction

1.1: Goals and Overview

The main goals of this project are to understand how the stock market operates and behaves, how to invest in the stock market, and to determine the best techniques to use in order to maximize earnings. This will be accomplished by using an online stock market simulator in order to purchase stock and analyze how the prices fluctuate throughout a four week simulation period, with a focus on taking different positions by different methods. This ideally will yield an excellent diversity of experience in investing and finance.

As an additional component of the project, we will be attempting to either prove or disprove the theory proposed by John Bogle, founder of The Vanguard Group, Inc., which states that trading in the stock market piecemeal is a losing game, and that the winning strategy is to buy a piece of the whole market (via index funds) and hold it forever.

1.2: Brief History of the Stock Market in the United States

Prior to the Revolutionary War (1775-1783), there was no stock exchange in the American colonies because money matters were controlled and handled in London due to British rule. However, the result of the Revolutionary War was independence from British rule and now financial matters were the responsibility of the states. Thus, one of the first stock exchanges in America was founded in 1790 in Philadelphia (known as the Philadelphia Stock Exchange). The only shares that could be purchased were from the first three banks of the United States: Bank of North America (founded 1781), Bank of New York (founded 1784), and First Bank of the United States (founded 1791). Due to the expenses of the war, all the profit from the shares sold was used to pay off the associated debt. On May 17, 1792 in what would be come to known as the

Buttonwood Agreement, twenty-four stock brokers created the New York Stock & Exchange Board (which is known as the NYSE or New York Stock Exchange today). The New York Stock Exchange has grown to become the largest stock exchange in the world today. The other primary stock exchange in the United States today is NASDAQ, which stands for the National Association of Securities Dealers Automated Quotations. It was founded in 1971 by the National Association of Securities Dealers. NASDAQ was the first computerized stock market in the world and also was the first stock exchange to advertise to the public. Today, NASDAQ is the second largest stock exchange in the United States and is number one in the world for the number of trades that take place within the stock exchange.

1.3: Definition of Stock and Shares

Stocks are “a type of security that signifies ownership in a corporation and represents a claim on part of the corporation’s assets and earnings” (dictionary.com). In the physical plane, a stock certificate is simply a contract, a notarized piece of paper corresponding to a stake in the company. There are at the very basic level two types of stock, “Common” stock and “Preferred” stock. Common stock has two primary benefits: it can gain value and be sold for profit or it can be retained and the holder will receive quarterly (usually) dividends. However, dividends are dependent on the company’s ability to receive or increase its earnings because dividends are dispensed using the company’s earnings. Preferred stock differs from common stock in that although it doesn’t provide as much room for profit, it guarantees dividends. In addition, holders of preferred stock are allowed to vote on company decisions and are also paid prior to holders of common stock. These categories are not invariable or comprehensive, however, as the issuing company has some flexibility in what properties its stock issues have.

The amount of stock owned is quantified as shares. The amount of shares one holds also determines their stake in a company (in other words, how much of the company they own). For example, if a company has issued 1000 shares and an individual purchases 200 shares, he or she has a 20% stake in the company (owns 20%). A company can be either privately or publicly held (with great ramifications on how its management is regulated). The essential difference is that a publicly held company's stocks are available for trade on the open market, whereas those of a privately held one are not. A private company can "go public" by conducting an Initial Public Offering, where shares are created and sold to the public. IPOs became a particularly prominent phenomenon during the Dot-Com bubble of 1995-2001, as covered later. The final fundamental stock behavior is a "split," where a company decides to let each stock entitle the bearer to more shares, with a corresponding decline of the value of each.

A company's total valuation is determined by multiplying the number of shares available by the current market price per share. This is referred to as the company's *market capitalization*. For example, if a company has 1000 shares available at a price of \$10.00 per share, the company is valued by the market at \$10,000. One important use for market capitalization is how the major indexes are weighted. The Standard and Poor's 500 (S&P 500), for example, indexes the 500 stocks weighted by greatest market capitalization, and uses that price as an (amazingly good) indicator of the performance of American industry as a whole. Notice that the word "value" is never used in the absolute sense here: the idea is that no asset has an intrinsic value independent of offers to pay for it. The valuation is what the market is willing to pay.

1.4: Influences on the Price of Stock

If one could accurately predict where the price of stocks was headed, one could write his own ticket to a life of ease and luxury. Sadly (or perhaps consequently), this is a problem that math doctorate recipients routinely fail to solve, often spectacularly.

Ideally, the share price would clearly reflect the value of the company and respond only to real changes in its well-being in real time, as determined by supply and demand, the basis of economics. Simply put, if the shares of a company are in high demand (because the company is doing well), the price per share would increase. Similarly, if there is a surplus of shares and little demand (due to poor performance), the price per share would decrease. The price itself would tend towards the amount that the assets of the company would be worth if disassembled minus the outstanding liabilities. This makes sense, as this is the definition of equity, and stocks are, after all, an equity security.

In reality, since the market is comprised of human beings (albeit aided by some well-programmed machines) volatility can be enhanced by other factors: to wit, if a major holder of a company's stock decides to sell it off, other investors may wonder if some information asymmetry is being capitalized upon, and follow suit. This mob action could cause further fear and further devaluation of a stock. Conversely, if Warren Buffet decides a stock is a good investment, people can be trusted to follow along. It is clear then that investor confidence (and thus share price) is greatly influenced by word of events. These can be anything from the resignation of a trusted board member, a lawsuit against a manufacturer, or perhaps a massive industrial disaster. For example, over the past six weeks, BP's (British Petroleum) shares have fallen 15% because of criticism over their lack of progress in the Gulf coast oil spill as well as their revelation that the total cost to date is over \$990 million dollars. Company disclosures also

drive stocks. For example, if a company warns its shareholders that it will not meet earnings targets, the share price may fall. Notice that these factors can be psychological solely: there may have been no change whatsoever in the underlying company or its earnings. One important measure to mention is that of Price/Earnings Ratio, which is market price of a share divided by earnings reported per share. P/E Ratio provides a good way to estimate the magnitude of speculation's effect on a stock price: if the price rises faster than earnings, some of the gains may be due to the emotional factors mentioned earlier, an expression of "irrational exuberance" (to quote Alan Greenspan) rather than more concrete factors. P/E Ratio is also a very important measure in the Dividend Discount Model, which the author of our hypothesis uses extensively. P/E Ratio will be examined more closely later as part of our approach to stock selection. As a side note, investor confidence (or lack thereof) in a stock can be expressed in many ways other than the simple buying and selling of stocks. One important measure is the price of a Credit Default Swap. This will be later discussed with the other securities, and will later become important in discussion of the Gaussian Copula.

1.5: Stock Purchasing Methods

When it comes to purchase stock, there are two methods: through a brokerage and through a DRIP and/or DIP plan. The use of a brokerage is a highly popular method by which to purchase stock. There are two types of brokerages: full-service and discount. Full-service brokerages provide market analysis and expert advice in addition to the brokerage service. Thus, commissions are typically higher for full-service brokerages. Discount brokerages on the other hand, do not provide any investment advice or market analysis and charge a lower commission. DRIP and DIP stand for dividend reinvestment plans and direct investment plans respectively. Both plans essentially allow companies to sell their own stock directly to investors for a low fee.

A DRIP provides the option of immediately reinvesting dividends back into the company, which means that the investor does not receive dividends. The advantage of this is that there will be no brokerage fees or commissions to pay and the investor will not have to wait until he/she has the necessary funds to purchase additional shares. A DIP is a more traditional system where an investor can purchase stock directly from the company, but will only be allowed to sell the stock on predetermined dates and times at a company calculated average market price. One of the subtle aspects of stock purchasing is that one can often purchase stocks without putting down all of the cash up front. This is called “buying on margin,” in effect buying stocks with money borrowed from the broker, with other securities as collateral (typically other stocks in the portfolio). This collateral goes into separate margin account, which typically has some minimum value equal to a proportion of the investment made. If the value of the investment (read: the stock price) falls enough, the buyer receives a “margin call” requiring additional funds, or the margin account is liquidated. Margin buying allows exertion of leverage (proportion of debt to equity backing a position) increasing the consequences of subsequent changes.

1.6 Derivatives

The term “derivatives” encompasses an almost endless variety of contracts based on things that do not actually change hands at the time of the transaction. If I sign a contract to buy a stock later at a fixed price, no stock actually changes hands at the time of the signing. The contract itself is a derivative, specifically one based on stocks, and even more specifically a future. This is just one of a multitude of types of derivative; only major ones will be mentioned.

1.6.1 Futures and Forwards

Two different contracts of the “agree to buy or sell something later at a set price” nature are commonly sold: futures and forwards. There are several important differences between the

two, however. The first is that the text of a futures contract has been standardized to the extent that, like stocks, they can be traded on exchanges; they are fungible assets. In contrast, a forward is an “over the counter” product, something agreed to only by the two parties involved. As a consequence, the risk for a futures contract is diffused to the clearinghouse guaranteeing the sale, where the risk for a forward contract is entirely on the selling party. The futures market does not center on the actual exchange of goods (which tends to happen on the spot or cash markets instead), it is usually used to hedge against risk. Futures contracts are often closed out before maturity, rather than exchanging of the underlying asset (since they are usually used to bet on direction of asset price), while forward contracts (since they are more often used to hedge against volatility of asset price) are usually settled by exchange of assets or cash. A rancher could buy a corn forward to insure an economical supply of cattle feed at harvest time, for example. Another major difference is that the margin for a futures contract is re-calculated (typically every day), while a forward is not margined at all, with any change in value happening at exercise only. Forwards are inherently more risky for this reason, among others.

1.6.2 Options

In contrast to a future or forward contract in which the contract carries an *obligation* to purchase or sell later at a set price, a separate category of contract exists which carries a *right* to do so, but not an obligation. These contracts are known as options. The two major types give the right to buy at a fixed price (a call option) and sell at a fixed price (a put option). In the terminology of taking positions (on whether a stock will rise or fall), the investor “writing” a put (selling it) or buying a call is taking a short position, betting that the stock’s value will decline over the term of the contract. The investor writing a call or buying a put is taking the converse long position. Options contracts can either be exchange traded or OTC, with the same

consequences that followed for futures and forwards. Using options to take a position instead of buying or shorting the underlying stocks has the advantage of, for the same price, allowing one to leverage a higher number of underlying shares. Stock options are a fundamental part of executive payment packages, usually consisting of a call option, allowing the executive to buy stock at some low price in the future. This ties the option to company performance: the higher above the strike value the stock is, the more profit is made on the options. What a given option is worth *before* the strike date, however, is a non-trivial problem and requires some significant modeling assumptions and mathematical complexity. The major model used for this purpose is known as the Black-Scholes formula, which is a set of partial differential equations.

1.6.3 Swaps

Historically, the term “swap” referred a trade in bonds or stocks, exchanging cash flows. The purpose was to exchange the maturity of bonds, or the type of investment. The contract making the exchange is a swap contract. More recently, however, the variety of swapped assets has broadened quite a bit, including foreign currency and interest payments.

1.7: Bonds

Bonds are essentially loans given to companies and/or governments by an investor(s) that promise to repay the balance of the loan (termed face value) in a certain amount of time (termed maturation date) in addition to interest (termed coupon). For example, if an investor buys a bond with a face value of \$100, an annual interest rate of 10%, and a maturation period of 5 years, he/she will receive \$10 a year for 5 years in addition to being repaid the initial balance of \$100 at the end of the 5 year period. Bonds are classified as debt securities because the bond owner purchases a debt and becomes a creditor. This has its advantages over equity based securities such as stocks. The number one advantage is the lower risk associated with owning bonds

because they are fixed-income securities (the owner of the bond is aware of the final payout amount at the time of purchase). Another advantage is that in the event that the issuing entity files for bankruptcy, bond owners will be paid prior to shareholders. Of course there is a compromise in owning bonds in that there is a lesser risk at the cost of lower returns.

Bonds can be issued by local governments to pay for projects or raise money; these are called municipal bonds. For example, a city could issue a bond to build a new bridge and pay the holders with tolls. Since the states have no power to tax federal spending and the converse applies, municipal bonds are often tax free at the federal level as a result. Many municipal bonds are in fact totally tax free. This of course is compensated for by a decrease in average interest rates. Municipal bonds also typically have a minimum investment in the thousands of dollars, which can limit their utility to small investors. As a side note, some funds exist that consist entirely of tax-free municipal bonds, allowing smaller investors greater utility with a safe and tax free income.

1.8: Purchasing Bonds

A key issue to consider when purchasing bonds is the risk as to whether or not the company will be able to stay out of bankruptcy, or will default on the debt. The U.S. government has virtually no risk of defaulting on a bond; as the issuer of currency, it can just print more money to cover any bond it issues (with associated inflation). Municipal bonds HAVE defaulted in the past, but those individual incidents are historically significant: it happens exceedingly rarely.

Investors love risk, as long as it's recognized and compensated for. A major kind of player in the global financial market attempts as its sole function to identify and label risk by

levels, facilitating trading and easy comparisons. Ratings cover all the ground between “high quality” and “already in default.” If these credit rating agencies gives a high enough rating (above BBB-, by S&P terms), securities can be referred to as "Investment Grade." U.S. Treasury securities are generally considered to have a rating above AAA (on the S&P) scale, with a correspondingly superlative rating for the others; for reasons discussed above, they are considered “risk-free.” Lower-rated bonds are relegated to "junk bond" or more optimistically, "high-yield bond" status. A person of significance for this topic is Michael Milken, who in the 1970s and 1980s recognized an untapped potential in junk bonds and almost singlehandedly developed the market for them, making surreal amounts of profit (sometimes 100% return on investment), and later ending up in jail for illegal practices.

Bond Rating		Grade	Risk
Moody's	S&P/ Fitch		
Aaa	AAA	Investment	Highest Quality
Aa	AA	Investment	High Quality
A	A	Investment	Strong
Baa	BBB	Investment	Medium Grade
Ba, B	BB, B	Junk	Speculative
Caa/Ca/C	CCC/CC/C	Junk	Highly Speculative
C	D	Junk	In Default

Table 1: Bond Ratings

Although bonds are fixed-value assets, their price can fluctuate based on the current interest rates. If the interest rate increases, the valuation of the bond decreases and vice versa. This can be beneficial to the bond owner. In general, the bond owner’s objective is to maximize the *yield*. Yield is a measure of the profit (accrued interest) that one makes as a result of cashing a bond. For example, a \$500 bond with a 10% coupon has a 10% yield (\$50/\$500). However, a buyer tries to maximize the yield by getting the bond at a lower price (example: purchase a \$500 bond for \$300 and the yield now becomes \$50/\$300 or 16.7%). Similarly, if an investor already

owns a bond, he/she would like the price of the bond to increase over time since the interest rate is fixed (example: purchase a \$500 bond for \$500 with 10% coupon and at the end of the maturity period of 10 years, the price of the bond has increased to \$750 due to interest rate fluctuation, final payout will be \$500 in interest in addition to \$750 for a total profit of $\$750 + \$500 - \$500 = \750). Thus, we can see that bonds can offer much less risk than stocks with the potential of a reasonable return (although it still won't be as high as that offered by investing in stock).

1.9: Mutual Funds

Mutual funds are essentially a collective investment in stocks, bonds, or other securities. The goal of any mutual fund is to minimize risk while providing the potential for large growth over extended periods of time. Basically, a group of investors give their money to a fund manager, who is an expert financial analyst and can make informed decisions as to what kind of securities are best to invest in at the moment. Mutual funds can have as many different strategies as an individual investor can, for example either focusing on a particular market segment or trying to follow a market index. Mutual funds can be actively managed, hunting for profit at the cost of turnover, or passively managed, trading as little as possible. There are three potential methods for profit. The first is much like the dividends that are issued to share holders of a stock and interest that is earned by bond owners. Annual payments of all dividends and/or interest accrued are issued to all investors in the mutual fund and this is known as a *distribution*. The second method to earn profits is by selling any securities that have experienced growth. These profits are also dispensed to all investors in the mutual fund as a distribution. Finally, any unsold securities can be sold to another investor in the mutual fund for profit (provided that the price of the securities has increased). The main advantages of a mutual fund include potentially reduced

risk through greater diversification than would be otherwise possible (funds are only way to, in effect, buy a fraction of a stock) and the ability to cash out (sell holdings and withdraw from the mutual fund) at any time. Disadvantages include the difficulty of assessing the fund manager's competence (as we'll see later, past performance is not always a good gauge for future performance) and the expenses incurred by fund overhead (salary for the fund manager, for example).

Chapter 2: Investment Approaches

2.1 Investment Tactics

The complexity and variety of financial instruments described earlier has given rise to a great many strategies. A buyer of a stock might also write a call option. If the stock's value rises above the exercise price of the call option, he can exercise it and claim a profit. If the stock's value falls, some of the loss is covered by money received as a premium (the sale price) for writing the call. A major subset of investment strategies do this, attempt to reduce risk by compensating for it with other investments and this practice is called hedging. Buying shares of Shoe Company A certain that Company A is well-managed and will make the best of the situation in its market, but then covering for the whole country perhaps wearing sandals instead by shorting Shoe Companies B and C to do so, is an example. As a matter of fact, with enough option plays, profiting from almost any predicted trend is possible.

Another strategy is that of arbitrage, capitalizing on pricing inefficiencies. A company's stock can be traded on more than one exchange with different prices. Given that both stock prices reflect the estimated value of the same company, the price should be the same. One can then bet that the prices will converge by shorting the higher and going long on the lower. Arbitrage is viewed as a low-risk means of obtaining small profits, a lot of leverage is needed to obtain significant return. One could also capitalize on the convergence of value on bonds of similar maturity, or perform similar tricks with the costs of option positions. The glut of information available in the digital age has reduced opportunities for these last significantly, as program trading decreases market response time. There are, however, entirely separate realms of strategy dictated by differing assumptions.

2.1.1 Technical Analysis

1. *Mathematics is the language of nature.*
2. *Everything around us can be represented and understood through numbers.*
3. *If you graph these numbers, patterns emerge.*

Therefore: There are patterns everywhere in nature.

- Darren Arnovsky (Pi)

The “Dow” of Dow Jones Industrial Index fame laid foundations in a series of editorial reviews for a discipline called “technical analysis.” The underlying assumption is that, with various mathematical rationalizations, the price and volume of a traded stock are enough information to predict where that stock’s price is moving by recognizing chart patterns. These predictions can then be capitalized upon with various options plays. One notable concept from technical analysis is that there are “support” and “resistance” lines that can be super-imposed on price behavior, where a stock price will rebound from either on its paths. Technical analysis has been criticized by the authorities whose opinions we have been following for our project.

2.1.2 Fundamental Analysis

Perhaps more convincingly to an engineering audience, the related discipline of fundamental analysis examines companies closely and attempts to determine if they are under or over-valued with respect to the market price. It then bets according to the principle that eventually the market will find the correct price. The data at hand is the financial statement of the company, those of its competitors, and information about the segment of the market in which it competes. One of Bogle’s main influences in founding the Vanguard 500 was the work of Burton Malkiel, who in “A Random Walk on Wall Street”, rejected the assumption of inefficient markets key to fundamental analysis. In further rebuttal of both cases, it has not been shown that adherence to either model carries better chances of success in the market.

2.2 Lessons From The Past

“Those who cannot remember the past are condemned to repeat it” - Life of Reason, Reason in Common Sense, Scribner's, 1905, page 284

It would be foolish to jump into even a theoretical investment experiment without some knowledge of how the game has been played in the past, and as engineers, we are pre-occupied with preparing for the worst case scenarios. Nothing exposes underlying principles of a structure like a good disaster, and nothing influences future developments in law and policy more than attempted avoidance of same. With this in mind, undertaken here is a study of past disasters in hopes of learning applicable lessons.

Furthermore, as individuals completely unversed in financial matters, deep curiosities about certain matters have been sparked over the years without means of answering them, until now. Why was the news in the year 2000 so uniformly bad? It sounded at the time like the whole economy was falling apart, when just before it had sounded like the stock market was basically a waterfall made of money just waiting for a bucket to be stuck into it. How did it become impossible for a young college student to get a loan for a new house? What are the chances that young college students are smart enough to “beat the market”? All of these questions will be answered.

2.2.1 The Dot Com Bubble

Over Christmas break in 1994, two Cornell undergraduates were able to raise \$15,000 and invest in an Apple Internet Server. A few months later, on April 1 1995, theGlobe.com went live. It was a social networking site, one of many capitalizing on the rise of the internet changing communication paradigms. After just a month in action, the two had attracted 44,000 visitors [1]. In November 1998, the company went public, issuing 3.1 million shares. The day after the IPO,

the company's market capitalization was \$841.8 million, with shares trading at \$94 [2]. By August 3, 2001, the shares traded below 25 cents. The company had never turned a profit [3].

This expression of market irrationality, an IPO going through the roof for a business with no profits, was utterly commonplace in the late 1990s. The heart of the optimism was found in the "network effect." A service that allowed one person to make a page with their information on the web? That's not worth much to say the least. The same service with one hundred million users, however, and analysts would predict, even in 2010, an IPO yielding a market capitalization in the mid to high double digit billions of dollars (Facebook) [4]. The appetite for this kind of business was boundless, with investors buying up stock for anything with a shiny



Figure 1: NASDAQ Index (Into The Weeds

new appearance. Companies could even add ".com" suffix to their name and see their stock price rise [5]. The business plan of each company being "get big fast" and figure out a way to make money off the user base later [6], the inevitable happened when many of them bombed soon after their IPOs. The result was the tech-heavy Nasdaq Composite losing 78% of its value (see above), and many of the dot-com "Siliconaires" rocketing right back into obscurity.

2.2.2 Mortgage Backed Security Crisis, Credit Crunch

It would be hard to overstate the impact of the subprime mortgage crisis on the U.S. economy and the lives of the American people. Unemployment has all but doubled and anxiety over the "credit crunch" has fueled endless debate on the news (and endless problems for those of us attempting to finance an independent life). The phenomenon's notability, however, does not

alone merit the inclusion of an analysis of these events into the documentation of a stock market simulation. As will be shown, the subprime mortgage crisis illustrates many fundamental attributes of some major players in the market and demonstrates the power and peril of some very new and exciting financial instruments.

While not illustrative of stock market concepts, some discussion of the root assets underlying the drama to follow is needed. With real estate values on an uninterrupted rise from 2002 on, there was great incentive for consumers to buy a house under any circumstances possible and benefit from the rise. Subprime adjustable rate mortgages were pitched as the ideal way for consumers with questionable credit history to do so. The most common were either 2/28 or 3/27 ARMs, with either a two or three year (respectively) flat rate period, after which the rate would float based on some index and some margin specific to the mortgage for the remainder. The intent was that customers with iffy credit would use the flat rate period to repair their credit by making the low payments, and then refinance the home with a prime mortgage using the increase in equity due to the rising market before the rate adjusted and the payments skyrocketed [7]. The housing crisis came about because the bubble burst and that equity was not available. Equity, of course is the balance of the market valuation of the asset with its liabilities. If market valuation drops and the liability (the mortgage) is the same, it's possible to end up with negative equity. This leads to late or defaulted payments, and eventually foreclosure. This left many subprime consumers in an ugly situation by 2007, when the crisis began in earnest as the market froze. As the crisis continued, even prime mortgage holders had problems as their homes lost equity as prices fell.

It has been adequately explained how subprime mortgages can become toxic assets. The question remains of "How did the losses incurred by subprime mortgage defaults spread

throughout the economy?" The answer lies within mortgage-backed securities. It has long been practice to lump several mortgages together (all fixed income assets) as a security. The problem has long been pricing them properly. The factors influencing default are myriad making for a very complicated modeling problem. For some time, then, the only mortgage-backed securities traded were ones deemed riskless by association with the federal government via Fannie Mae or Freddie Mac. The breakthrough that allowed the massive amount of later trading came in 2000 with David X. Li's development of the Gaussian Copula[8], which allowed mortgage backed securities to be priced (along with countless other financial instruments) by using Credit Default Swap prices to model correlation of variables. The models utilizing the Gaussian Copula banked on the CDS market prices reflecting risk accurately. Credit Default Swaps, incidentally, are a kind of "bet" that some other asset will default. This may invite comparison to insurance, but neither party in the CDS has to have any interest in the subject of the bet: akin to buying fire insurance on your neighbor's house, with all the moral hazard it entails. This innovation allowed the creation of securities pooling diverse elements together with a very simple expression of the risk involved.

The most significant novel financial instruments relevant to this discussion are called

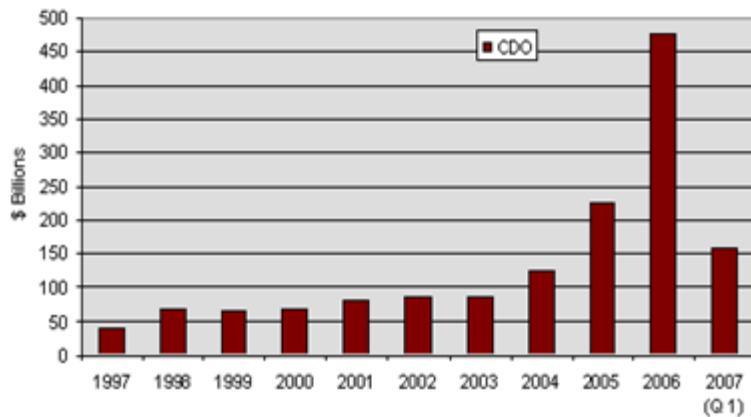


Image courtesy [Hammond Associates](#). The data presented herein are believed to be reliable but have not been independently verified. Any such information may be incomplete or condensed.

Figure 2 CDO Issuance 1997-2007 Q1

Collateralized Debt Obligations, or CDOs. This type of security organizes the mortgages into several tranches that constitute a capital structure with some senior and

some subordinated. The higher tranches' holders would get paid first in the event of default. Note that for a bank, securitizing a group of mortgages increases liquidity: the bank has cash in hand from selling the securities to invest in more real estate. CDO issuance absolutely SKYROCKETED with the housing bubble (see graph left), reaching a peak in 2006. Even more importantly, many of these newly issued CDOs were in fact CDO²s, or CDO³s. That's right, a CDO backed by CDOs backed by CDOs backed by subprime mortgages. Many traders and institutions could not be asked to check down through the many layers of financial abstraction to see that the mortgages beneath were bad assets. With the boom in CDO issuance, many portfolios were thoroughly exposed to the subprime crisis without awareness of the problem.

When it came time to get ratings agencies to evaluate these new securities so they could be sold, senior tranches could be rated much higher than ones representing subordinated debt, even though they were all backed by the same mortgages or securities. The problem was compounded by the abstraction of CDOⁿs: a security could be an amalgamation of AAA rated amalgamations of bad mortgages. Billions of dollars have been gained and lost on the merit of

ratings changes, security ratings are very serious business. Why, then, were these tainted CDOs traded as AAA? It represented a massive failure to recognize risk! To put it another way, "about 90 per cent of the products rated as investment grade by Moody's in 2007, for example, have since been relegated to junk status. By 2007, the housing boom was already gone. The smart money had seen the mess coming two years ago [9]. How could they be that wrong? The answer lies within incentives: everyone from bank to investment group to investor was making a lot of money, and no individual party wanted to incur the wrath of the rest by being the one to sound the alarm. A credit rating agency collects fees from the creator of the security. A credit rating agency that downgraded its rating of assets held by its major business partners would provoke hostility and lose business. Thus, warnings were ignored.

Several important lessons can be gleaned from this exercise. First of all, one must acknowledge the inevitability of Black Swan Events, a term was created by Nassim Nicholas Taleb and expanded upon in his book "The Black Swan." For recorded history, all swans were known to be white in European society, and it was taken as an absolute truth. This is analogous to how the implementation of the Gaussian Copula looked at only CDS prices from the time that CDSs had existed: the last 10 years [8], and within that realm it allowed a great approximation of what appeared to be very little risk. To continue the analogy, explorers in 18th century Australia found *Cygnus atratus*, the black swan, shattering the notion of a white swan planet. This discovery is akin to the real estate bubble's ending and cataclysmic consequences.

A second lesson involves mathematical models: the results of even a brilliantly constructed model are worse than useless without a complete understanding of the operation of the model and its underlying assumptions. The crisis happened because fund managers could

take the risk values from the quantitative analyst's models and make decisions without understanding anything about the model.

The final lesson is that all parties involved in any transaction act only in their best interest. A ratings agency has motives for rating the way it does, and taking a rating at face value and letting that be the sum of the investigation is a mistake.

2.2.3 Long Term Capital Management

"There are two kinds of people who lose money: those who know nothing and those who know everything," - Henry Kaufman

As previously discussed with regard to CDOs, pricing derivatives is not easy. It was a great leap forward for economics as a science in 1973 when Robert Merton, working on a model proposed by Fischer Black and Merton Schoals, published an (arguably) novel model for pricing options. For this, Merton and Schoals later received the 1997 Nobel Prize in Economics (Black was not eligible, as he had passed away). It is safe to say, then, that Long Term Capital management had some high-caliber minds on its Board of Directors. A hedge fund formed in 1994 by John Meriwether, a former head of bond trading at Salomon Brothers [10], the fund had over a billion dollars in starting capital. Their game was arbitrage: capitalizing on changes in relations between different securities. The value of a 29-year T-bill and a 30-year T-bill should eventually converge, so LTCM shorted the lower-yield bond and went long on the other, using massive leverage to turn a profit on a tiny margin. A wide variety of bets went badly, and after two years of 40%-plus annual profits, LTCM lost billions of dollars on very short order and had to be bailed out to avoid causing a liquidity crisis for the whole market.

We've seen, through analyzing past crises and failures, how very smart people can manage to lose a lot of money very easily. If Nobel laureates in economics running a hedge fund

with all the resources in the world can wipe out their investors "playing the market," what hope does any average man have of doing so successfully? The sane and sober answer is: "not much."

2.3 Lessons

One might suggest entrusting one's money to smarter men, men investing as a full time job. The typical choice would be a mutual fund, where investments can be spread to diversify much farther than an individual could, as a diverse portfolio is universally held to be good investing practice. Unfortunately, fees within the mutual fund industry have been the subject of Supreme Court cases (e.g. Jones v. Harris Associates) as rational minds have attempted to rein them in. The case most recently ruled on revealed that one mutual fund would charge as much as twice as high a fee to individual consumers as corporate pension fund partners for the exact same services. The average mutual fund turns over its portfolio entirely every year (Bogle 36), and the expenses (even without fees) associated with this are not trivial. In fact, the overall cost of equity fund ownership can be 3-3.5%/yr: the expense ratio is about 1.5%/yr, adding 0.5-1%/yr for sales charges and portfolio turnover up to 1%/yr.

Even more disappointingly, many academic papers have been publishing showing that mutual funds do not "beat the market," and that those that DO often fall behind soon after.

According to Davin Swensen, the CIO of the Yale Univ. Endowment Fund, "a miniscule 4

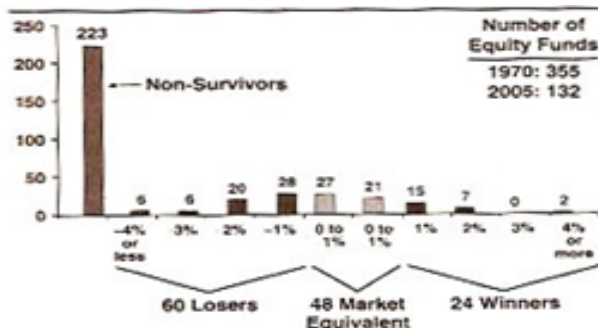


Figure 3: "Winners, Losers, and Failures: Long-term Returns of Mutual funds, 1970-2005"

percent of funds produce market-beating after-tax results with a scant 0.6% annual margin of gain."(Bogle 33) Of the tiny portion of funds that beat the market, they on average do so only

barely!

As the graph at left shows, (Bogle 79) the odds of picking a mutual fund that outperforms the market are very long indeed. The largest bin by far is mutual funds that went out of business, and only TWO outperformed the market by more than 4%, out of three hundred and fifty five funds! Michael Mauboussin calculates odds of fund outperforming 15-year market at 1 in 223,000. For 21 years? 1 in 31,000,000!

A further complicating factor weighing in against mutual funds in terms of one's ability to select a good one is that past evidence has shown overwhelmingly that one's first instincts are often wrong. Before the dot-com crunch, only about 20% of investments went into "aggressive" equity mutual funds. These funds are actively managed and attempt to hunt profits... aggressively. Aggressive equity mutual fund investment made up 95% of inflow in 1999-2000, when the bubble burst! (Bogle 55). People tend to jump into a particular fund at the worst possible times. The lesson is that strategies that have been working *great* (aggressive funds pre-bubble burst) often do far worse than strategies that merely do well (index mutual funds) when things change. Looking at the five largest of these funds, 21%/yr was made from 1996-2000. This was well above the S&P 500's return of 18.4%/yr, clearly beating the market. With the bubble bursting '01-'05, the aggressive funds all went negative while the index fund made less than 1%/yr. Averaged out, it came to about 7.8%/yr for aggressive equity mutual, 9.1%/yr for index. Sounds okay, right? Well, the fund may have done okay, but thanks to capital inflow diminishing the per-dollar return, the average shareholder lost 0.5%/yr. Average index shareholder? They made 7.1%/yr. Compound the fund return over the whole period from 1996-2005, the index fund returns 112%. The aggressive mutual fund returns 4.5%.

What, then, about acting as an individual and working with a conventional brokerage house? A broker only makes money when a financial product is sold, and the size of

commissions often depend on deals made on the part of the brokerage. This, simply put, is a moral hazard. The broker's incentives do not necessarily align with that of the investor. Even legally, brokers "are now only required to steer their clients to "suitable" products — based on a customer's financial situation, goals and stomach for risk." [11] Although today's media covers a swing towards re-branding brokers as "advisers" that must meet separate legal standards, the hazard remains. The adviser might not have an ulterior motive in selling the client a specific stock, but the fact remains that the adviser has an incentive to perform actions, to buy or sell. One doesn't need an adviser to remind them to hold onto their assets.

Let's assume for the moment that adviser is honestly acting in the best interests of the investor. In July 1993, the New York Times began a series where five advisors were given \$50,000 imaginary dollars to invest over twenty years. In 2000, the best-performing advisor had about \$105,000. The average was about \$88,000. An index tracking the S&P 500 would have earned \$138,000. Okay, perhaps these particular advisers were just poor performers. In a study of 26 years of advisor newsletters, 25 of which were in circulation in 1980, only 13 were still in business in 1996. Only three had outperformed the market by any margin. Of the other 22, only two were ahead when they left the market. (Bogle 111)

John C. Bogle made history in 1975 by creating the First Index Investment Trust. It was the first ever index fund, using minimal management to approximate market as a whole as closely as possible. It is, of course, impossible to own proportional shares in every last company in the whole market, it would be an enterprise of unending complication. An index fund instead uses various financial instruments to keep up. Futures contracts based on the major indexes (such as the S&P 500 or Dow) are a major tool, as their value directly reflects the performance of the index, which very closely follows the performance of the economy as a whole (the S&P 500,

from 1931 to 2006 has had 98% correlation with the total market [12]). Why follow the economy as a whole? Simply put, the hypothesis is that stock price fluctuations are not truly predictable and playing the stock market is a losing game. Investors as a whole cannot outperform the



Figure 4: Investment Return versus Market Growth - Growth of \$1, 1900-2005

market, for every gain by one investor SOMEONE has to lose. Factor in the fees and overhead from trading actively, and you have a losing game. The core value of the economy is

not ethereal. It is a steadily growing quantity representing productive industry, with stock market expectations being a mess of stochastic noise obscuring it. From the perspective of investment value growth, the Great Depression was a mere blip! (Bogle 11)

Why do people ignore the obvious? Why talk of "star investors" beating the market and making millions when it is clearly a game of chance? More specific insight comes from Nassim Nicholas Taleb who, in "Fooled by Randomness," imparted one of the most important realizations relevant to the strategy pursued here. If investors that "blow up" by making a bad bet and losing a lot of their own or other people's money (as a broker or money manager) drop out of the business (due to lack of funds if it was an individual, or getting fired and becoming unhireable as an agent) and are thus never heard from again, then it is merely the process of elimination that gives us successful active investors. To paraphrase a story from Taleb, if investing was a sheer matter of chance (which we've argued here persuasively) modeled as a coin toss with a potential gain or loss of \$10,000 ten thousand investors after ten years would yield almost ten people who had never lost a bet by chance alone. *Someone* has to win, but it doesn't mean that a winning record is indicative of anything other than randomness. The stars

here are only people that haven't yet blown up! This plays right into the human mind's inherent optimism. We as investors (with hearts set on achieving success) ignore failures and idolize successes, even if the difference is only probabilistic. No one wants to look at their string of lucky guesses and see it clearly: it feels a lot better to be a "star investor" than a lucky idiot.

To understand such a probabilistic system, one must think in terms of the underlying randomness and accept it. The Black-Schoals model for options pricing incorporates an assumption of Brownian motion on the part of stock price and there is good reason to believe that this is a good approximation: price trends on a fine enough scale are truly random. Taleb mentions a ground-breaking paper by Robert Shiller in which it is mathematically derived that stock prices are entirely too volatile to be based on some tangible manifestation of value. It goes without saying, then, that if one were to track even a good investment very closely, one will see a fair amount of loss along with the gain. Across a whole year, the stock may gain, but follow it closely enough, and you'll see losses. Up close, one sees only the volatility, not the trend, and humans are not adjusted for this. Psychologically each loss about feels about twice as bad as each gain feels good. These losses can goad people into making rash decisions. As Warren Buffet said, "The greatest enemies of the equity investor are expenses and emotions."

Taleb lists several ways that one can be a "fool of randomness." Each of these represents a denial of the possibility that randomness will intrude violently (Taleb 79).

1. Committing to a position to excess – As Taleb says, "loyalty to ideas is not a good thing for ... anyone"
2. Tendency to switch from being an investor and holding things long-term while losing to being a trader and changing positions rapidly when winning.
3. No plan for the worst-case scenario
4. Absence of reflection in the face of losses

5. Denial that losses are a result of methods

2.4 Our Approach

So, based on the hypothesis, we are going to test John Bogle's theory regarding short term investments being a losing game. In order to accomplish this, we are going to select companies to purchase stock in (simulated of course), and trade actively in them with the goal of maximizing profits. At the end of the four week simulation period, we are going to examine the performance of our portfolio to determine how well it supports or refutes Bogle's ideas by comparing them to the return of an index fund over the same period, and analyzing the costs incurred by active trading. Our simulation will be conducted using the online investment website simulator called Investopedia (owned by Forbes Digital). We will be starting with \$100,000 in simulated funds. Before achieving a level of comfort with financial reporting and analysis, Ford Motor Company, Apple, Google, Inc., and BP PLC were chosen as initial investments.

2.4.1 Rationalizations

Ford Motor Company was chosen because they have experienced overall growth since the government bailout controversy that befell the domestic automakers in the first half of 2009. Ford was the only company that did not request government aid to avoid filing for Chapter 11 Bankruptcy. General Motors and Chrysler Corporation on the other hand, did request government aid. Therefore investor approval and confidence in Ford has increased and along with the increasing reliability scores that Ford has received, we feel that there is a lot of potential for further growth. Finally, Ford has just recently released the highly anticipated 2011 Ford Mustang GT 5.0 and early reports suggest that these vehicles are flying off the lots. So, it is evident that Ford's stock prices will continue to increase for the foreseeable future.



Figure 5: Ford Stock Prices, Sep. '08 – May '10

Apple, Inc. was selected because their products generally set the standard for consumer electronics, especially ease of use and innovativeness. A perfect example of this is the new Apple iPad, which was released only a couple of months ago, but has already redefined in home entertainment. Also, Apple tends to release new products during the spring and summer months, so share prices climb as a result. One of the major reasons why we have selected to invest in Apple is because there are rumors circulating that the next generation iPhone will be released in June. Considering the way the first generation device has transformed mobile productivity, entertainment, and communication, we are anticipating that share prices will soar when the latest device is released.



Figure 6: Apple Stock Prices, July '09 – May '10

Google, Inc. has not been doing well lately as evidenced by their falling share prices. However, past performance would seem to suggest that they will recover, especially with updates to their Android mobile operating system. Also, Google is a highly ambitious firm as we saw when it purchased the popular video site YouTube for \$1.65 billion. Overall, we feel that now is a good time to purchase a significant number of Google shares since they are selling at a lower rate than in the past. We are hoping that Google's innovative software and web technologies will result in a significant increase in share prices in the near future.



Figure 7: Google Stock Prices, July '09 – May '10

The final company that we have decided to invest in is BP (stands for British Petroleum). Although BP's share prices have fallen astronomically in the past few weeks due to their failed efforts in the Gulf coast oil spill disaster, we feel that efforts to fix the problem are progressing. We are in agreement that the best option is to purchase \$10,000 in BP shares while they cheap and then hope for a resurgence in share prices once the demand for crude oil prompts renewed confidence in BP.



Figure 8: BP Stock Prices, Last Three Months

Company	Amount to be Invested
Ford Motor Company	\$30,000
Apple, Inc.	\$30,000
Google, Inc.	\$30,000
BP, PLC	\$10,000

Table 2: Fund allocation

2.4.2 Criteria to Evaluate Stocks

In the wake of this decision, more serious thought was given to our ability to “see into” a stock and assess its performance. Criteria had to be selected to evaluate our past choices and guide future ones. In reading, several major criteria popped out:

1. Market Capitalization
2. Evidence of Long Term Trends
3. P/E Ratio
4. PEG Ratio
5. Profit Margin

In modern portfolio theory, a concept exists called “the efficient frontier.” The idea is that there is a clear relationship between price and volatility (conceived of as risk), and that the efficient values form a curve (maximal price for volatility). On the low end are such investments as Government bonds that have low risk and low rewards. At the very high end, one has small-cap stocks and corporate bonds. As beginning investors, large-cap stocks (often defined as greater than \$9 billion dollars) were a logical place to start. They represent the shallow end of the stock investment pool, which might help us avoid going too far underwater.

A further criterion that would seem useful on its face is “what has this company’s stock been doing for the last six months or so?” It would seem to be a reasonable period of time to look at, considering that further back may have been with different management or under different circumstances, and sooner may not be enough to see any slow-moving trends. A look six months into the past could provide some insight into what was happening, if one was mimicking the behavior of a typical investor (of course, both Bogle-heads and followers of Hume know that past performance is no guarantee whatsoever of future performance).

As mentioned in Section 1.4, stock valuation, P/E Ratio is one of the important numbers attached to a company’s stock market performance. To reiterate, it was stated that it is the ratio of the *Price* per share over the reported *Earnings* per share, and can be thought of as a measure of the influence of speculation on stock price. It allows investors to compare companies of different size and in different market sectors on a level playing field, providing a simple relative measure of how “cheap” or “expensive” they are with regard to their earnings. In reading, the standard we came across calls 15 to 25 a decent valuation. Lower P/E values can indicate an under-priced stock (and a potential bargain), higher ones can indicate a stock that is over-priced,

and a possible hazard. This will be one criterion for our stock picks, but not one cast in stone on the lower end. We are after buying opportunities *and* good values, after all.

The PEG ratio is the ratio of the P/E ratio to the annual earnings per share growth (the time-derivative of the Earnings mentioned earlier). It adds some information to knowledge of the P/E Ratio as it accounts for expectations of growth. This is a two-edged sword, of course, because predicting the future (as shown in earlier sections) is risky business. The lower the PEG ratio, the higher the expected growth relative to the company's current valuation is. It is worth repeating that the PEG ratio is based on *projected* growth in earnings, and is a markedly less concrete measure than the previous two.

The profit margin is quite simply the ratio of the net profits to the revenue from sales. For example, if a company makes a profit of \$1000 from revenue of \$10000, their profit margin is 10%. This measure in essence represents a company's ability to control costs. If the company is increasing its earnings rapidly but with a declining profit margin, it is clear that costs are not being managed as well as possible during the period of growth.

2.4.3 Evaluation of Choices

Company	Capitalization (in billions USD)	Positive Trend (over last 6 months)	P/E Ratio	PEG Ratio	Profit Margin
Ford Motor	35.02	Yes	6.59	.40	4.96%
Apple, Inc.	224.75	Yes	15.19	1.02	21.15%
Google, Inc.	139.04	No	13.70	.93	28.30%
BP, PLC	91.91	No	4.20	1.00	7.57%

Table 3: Selection criteria, selected four stocks

Viewed through the lens of our new criteria, how did our gut instincts treat us?

The Ford Motor Company falls a bit short of the “large-cap” label, which might mean it is a bit more volatile than it would likely be if it was larger, but P/E Ratios suggest a possible under-valuation, and the PEG ratio is the lowest of all. It is tough to compare Ford’s profit margins to its close American competitors, as General Motors is now privately held, as is about 80% of Chrysler. Toyota’s margin is about 0.7%, which is encouraging news.

Apple might be almost as well off by these standards. Massively capitalized, it should be a slow moving target, and if its positive trend continues, a profitable one. The P/E ratio shows the possibility of slight under-valuation, but the PEG ratio shows signs of slowing growth. Google is very similar in a lot of ways, and not just in terms of market sector, but with what appears to be a slightly greater predicted growth rate and higher profit margin.

BP is probably the most troubling of the stock picks on these numbers alone. The stagnant PEG ratio and signs of rock bottom P/E are not particularly good signs. It is possible that the P/E Ratio represents undervaluation and a good buy, but this carries with it strongly pessimistic market opinion. Instinctively these things are reflected in the lesser investment in BP versus the others.

Chapter 3: Simulation Results

3.1 Week 1 Data:

Week 1 initially seemed like it was going to be highly unsuccessful because we lost nearly 4% of our account value (almost \$4000) in a span of one day. However, by the end of the week not only had we recuperated the deficit, but we had also made a profit of about \$270. Needless to say, this was a very promising and confidence inspiring result. The following table shows our portfolio, which includes the company, symbol, share purchase price, share closing price (at the end of trading on Friday, 6/11/10), total value of the shares (number of shares x current share price), the percentage change in value, and the net gain/loss:

Account Value (USD): \$100,190.80 Buying Power: \$50,191.97 Cash: \$193.14 Annual Return: 5.50 %							
Stock Portfolio			Trade Stock		Symbol Lookup		More
Symbol	Description	Qty	Purchase Price	Current Price	Total Value	Today's Change	Total Gain/Loss
Sell F	FORD MOTOR CO	2704	\$11.14	\$11.40	\$30,825.60	\$0.00(0.00 %)	\$703.04 (2.33 %)
Sell AAPL	APPLE INC	119	\$253.24	\$253.51	\$30,167.69	\$0.00(0.00 %)	\$32.13 (0.11 %)
Sell BP	BP PLC ADR	271	\$35.83	\$33.97	\$9,205.87	\$0.00(0.00 %)	-\$504.06 (-5.19 %)
Sell GOOG	GOOGLE INC A	61	\$487.85	\$488.50	\$29,798.50	\$0.00(0.00 %)	\$39.65 (0.13 %)
Total:					\$99,997.66	\$0.00(0.00 %)	\$270.76 (0.27 %)

Table 4: Portfolio information for Week 1 (6/7/10-6/11/10)

As can be seen in the above table, BP was the only stock that took a loss over the course of the week. We had anticipated this because BP is receiving heavy criticism from both the U.S. government as well as the local population in the Gulf coast over their lack of effort and success in remedying the oil spill there. In fact, BP's share prices were actually lower (around \$32) during the first half of the week, but picked up almost \$2 by the end of the week.

News for BP, of course, was not positive. On Wednesday, the United States Department of Justice announced it was considering legal action to halt payment of dividends to BP shareholders in the wake of the disaster. This is perhaps worse news for BP's standing in the British stock market than ours, as "BP dividends accounted for some 12 percent of all dividends handed out by British companies last year" [12] . On a somewhat positive note, it was announced in Thursday June 10th by Susan Daker and James Herron Of Dow Jones Newswires that BP had reached a daily containment of 15,800 barrels a day. It is not much in proportion to the "estimates from the first round of study varied from 12,000 to 25,000 barrels a day," but it is at least progress.

Our expectation is that BP share prices will continue to fall, but once progress is made in the Gulf and consumer confidence is restored, share prices should increase, yielding a substantial profit for us. Ford seemed to be the only consistent stock and posted daily profits with the exception of one day (Wednesday). Ford also posted the greatest profit for the first week, with a gain of \$703. However, we are not expecting to make large profits because the share prices are cheap and there is no reason for them to increase significantly in the near future (no new Ford products are supposed to be released within the next month and monthly sales have remained relatively constant). In fact, Ford's only significant news mentions were an enthusiastic speech by Chief Executive Alan Mulally explaining Ford's strong position regardless of the end of the Mercury brand and a Ford pace car being debuted at the nearby Michigan International Speedway for the first time in 41 years.

The Apple and Google stocks were very unpredictable throughout the week. Some bad press had Apple's name in the spotlight during the week, which may be part of the explanation. On Wednesday June 9th, AT&T revealed that a security breach had exposed iPad user's private

information. Gawker carried word that intruders had successfully “obtained the e-mail addresses of top level politicians, television reporters and business executives, including White House chief of staff Rahm Emanuel,” as noted by Cecilia Chang in an article for the Washington Post [13], which went on to say that “14,000 e-mail addresses were exposed for iPad 3G users,” also according to Gawker. “The issue has escalated to the highest levels of the company and was corrected by Tuesday; and we have essentially turned off the feature that provided the e-mail addresses” read a statement by AT&T on the same day. It is possible that the public perceives the problem to be with AT&T, whose cell phone service has been widely complained about by Apple customers. The exploit itself seemed trivial: a script publicly available on AT&T’s website would return email address when prompted with ICC IDs.

CNet picked up a story just one day later that the Federal Trade Commission might be preparing to investigate Apple for anti-trust issues related to a story that broke on Monday, June 7th [14]. In November, 2009, Google purchased a subsidiary company called AdMob, having outbid Apple and engendered much ill will [15]. Six months of FTC review and 750 million dollars later, the acquisition was complete [16]. On Monday, however, Apple changed its terms of service in a way that made AdMob unable to convey information about how Google ads on the iPhone were clicked, making the acquisition much less valuable [17]. To quote Erica Ogg, writing for CNet: “It would appear Apple is blocking a major competitor from its platform, but while still allowing plenty of other, smaller ad networks to play.” At the time of stock market closing on Friday, there was no word from the FTC or the Department of Justice, but a fair amount of anxiety.

A troubling issue on the back burner is that of Foxconn, a Chinese Apple hardware supplier who has been embarrassed by a series of suicides at its factory and a subsequent halt to

paying of death benefits in its wake. Protestors picketed outside of a Hong Kong annual meeting on Tuesday, June 8th [18]. The amount of blowback experienced by Apple, protestors or not, is probably insignificant. Earlier in the week Apple introduced the newest version of Safari, Safari 5, promising faster and more secure browsing, with a highlight being HTML 5 support. Initial response is positive, but again, perhaps insignificant [19].

With the exception of the ongoing Apple versus Google slugfest over mobile devices supremacy, a major news item for Google was continued investigation into possible violation of privacy laws. “Google said May 14 that its Street View vehicles had inadvertently collected data over unsecured Wi-Fi networks” [20], and on Wednesday June 9th, New Zealand was added to the long list of countries beginning legal investigations.

Perhaps as a result of the above information (Google being denied the utility of its expensive acquisition and Apple’s legion of troubles), both stocks dipped simultaneously on Wednesday. However, by the end of the week, both stocks had appreciated to the point where we made a small profit (about \$72). For the coming week, we are expecting that both Apple (especially Apple because the iPhone 4 and iOS4 have been officially announced) and Google will yield better results than the first week. From the performance of this week, it seems that regulatory troubles are for both are expected but not a reason for a precipitous decline in stock price. Further developments in this vein may not affect price much.

The following table and accompanying graph show the price fluctuations and value of the portfolio throughout this past week (6/7/10 – 6/11/10). As can be seen, the portfolio lost about 4% of its overall value before recovering by the end of the week, a significant underperforming of the market. Compared to a fund tracking the index, it is in especially poor shape. Playing the

role of typical investors, the holders of this portfolio would probably be contemplating drastic action.

Date	Cash	Stock Portfolio Value	Option Portfolio Value	Shorted Stock Portfolio Value	Account Value
6/12/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/11/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/10/2010	\$193.14	\$99,200.24	\$0.00	\$0.00	\$99,393.38
6/9/2010	\$193.14	\$95,648.42	\$0.00	\$0.00	\$95,841.56
6/8/2010	\$193.14	\$98,978.33	\$0.00	\$0.00	\$99,171.47

Table 5: Portfolio value throughout Week 1 (6/7/10 – 6/11/10)

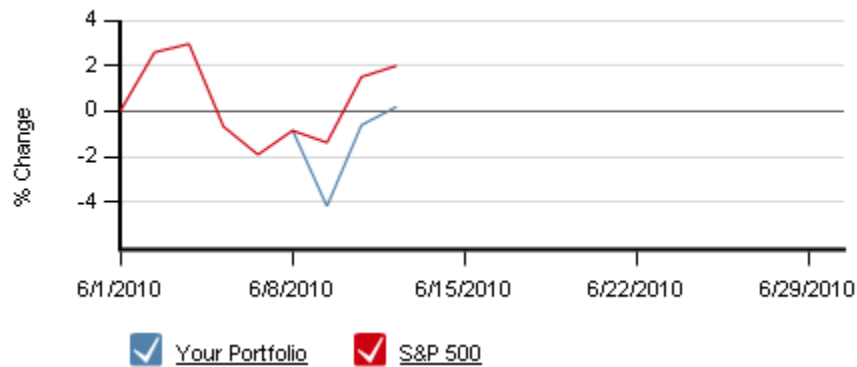


Figure 9: Graph of portfolio value vs. S&P 500 index value throughout Week 1 (6/7/10 – 6/11/10)

3.2 Week 2 Data:

Week 2 was a great week for us because as the table below shows, our portfolio made over 11 times the profit that it did at the end of trading last week. Overall, our portfolio has now appreciated \$2984.54 or almost 3% of our original investment of \$99806.86. We made an additional profit of \$162.24 with our shares in Ford Motor Company, which is 23% greater than our profit at the end of last week. To date, our total profit from our shares in Ford Motor Company is \$865.28. But it was Apple that took the cake for this week by showing a tremendous growth of \$2479.25 over our initial investment of \$30,135.56 (our Apple shares are now collectively valued at \$32,614.81).

Apple is now beginning to perform exactly as hoped. So far, Apple shares have appreciated 8.23% from the beginning of the experiment and we hope that as the new iPhone is actually released to the public and consumer feedback begins to circulate, that we will see even greater gains. There was plenty of mention in the media of anticipation for the new version of the iPhone, and plenty of hype for it versus Google's Droid. Not all news coverage was positive for Apple, however. Continuing security fears after the data breach at AT&T were stoked when Goatse security researchers complained about an exploit of Safari they revealed in March that had still not been patched [21]. Also troubling is the presumed spread of Mac-based malware, as indicated by Apple's unannounced addition of more malware signatures to Snow Leopard [22].

Due to the fact that BP share prices continued to fall (as expected) this past week, the net value of our BP shares fell by approximately another \$600. So far, we have lost a total of \$1102.97 or 11.36% from our initial investment of \$9709.93 (shares now valued at a total of \$8606.96). The outlook was further worsened by Standard and Poor's reduction on Thursday of BP's credit rating by another two notches, to "A." [23] An "A" rating is still five notches above "junk" status, however, and is termed "upper medium grade." This change was mirrored by the other ratings agencies. One of the cited reasons for the downgrade is that BP put aside 20 billion dollars in assets for a claims fund which was cited elsewhere in the Wall Street Journal as a reason for the energy sector doing a bit better that day.

Again, this was not unexpected and fear of loss was part of the reason why we chose to invest only 10% of our total available funds in BP. This is an illustration that close monitoring of long-held positions is probably unwise, because it would be no different now if BP *does* actually recover later. There was encouraging news in the past week, however, in that the CEO of BP, Tony Hayward was replaced as director of operations of the Gulf oil spill disaster by BP

Managing Director Robert Dudley. This might be just what BP needs in order to make progress on rectifying the mess in the Gulf. In this vein, BP was able to increase the amount of oil captured to 25,000 barrels to day (up from a reported 16,000 last week) [24]. Progress on the oil spill disaster would most certainly result in the rise of BP share prices eventually and we are hopeful that we will at least break even by the end of the simulation period. A further chunk of bad news fell on Wednesday, however, when estimates of oil leaking were raised to 35,000 to 60,000 barrels per day, up from 20,000 to 40,000 barrels per day last week [25], further emphasizing the long road ahead.

There was a lot of good news for Ford this week, corresponding to the stock's great performance. The Ford luxury-hybrid MKZ was certified by the Environmental Protection Agency at 41 miles per gallon city and 36 miles per gallon highway, making it one of the most fuel-efficient vehicles on the market [26]. Meanwhile, in Missouri, Governor Jay Nixon plans to announce Friday that he'll call a special session of state legislature to work on tax incentives for Ford there [27]. The icing on the cake was that Ford made the top five for J.D. Power and Associates Initial Quality rankings for the first time in the 24 year history of the survey [28].

Finally, the total profit for our Google shares thus far is \$742.98, which is a 2.5% gain on our initial investment of \$29,758.85 (total value of shares is now \$30,501.83). We feel that the main reason for the increase in share prices is the rumor that Google will be releasing an update or entirely new version of their popular Android mobile operating system (direct competitor to iOS4 by Apple). In a further development in the ongoing battle, Google intends to release a music service as a competitor to iTunes over the summer. It will probably not be smooth going, as Google rivals have not been kind to it in its attempts to break into new markets. When Lala

and iLike worked with Google to deliver music, both were soon acquired (by Apple and Myspace, respectively) and shut down [29].

Account Value (USD): \$102,904.58 Buying Power: \$51,548.86 Cash: \$193.14 Annual Return: 78.71 %							
Stock Portfolio		Trade Stock	Symbol Lookup	More			
Symbol	Description	Qty	Purchase Price	Current Price	Total Value	Today's Change	Total Gain/Loss
Sell F	FORD MOTOR CO	2704	\$11.14	\$11.46	\$30,987.84	-\$54.08(-0.17 %)	\$865.28 (2.87 %)
Sell AAPL	APPLE INC	119	\$253.24	\$274.07	\$32,614.81	\$262.28(0.81 %)	\$2,479.25 (8.23 %)
Sell BP	BP PLC ADR	271	\$35.83	\$31.76	\$8,606.96	\$13.55(0.16 %)	-\$1,102.97 (-11.36 %)
Sell GOOG	GOOGLE INC A	61	\$487.85	\$500.03	\$30,501.83	-\$3.05(-0.01 %)	\$742.98 (2.50 %)
Total:					\$102,711.44	\$218.70(0.21 %)	\$2,984.54 (2.99 %)

Table 6: Portfolio information for Week 2 (6/14/10-6/18/10)

The following table and graph show the overall growth of the portfolio since its creation. The total appreciation is 2.99% and as the graph shows, our portfolio's growth plot demonstrates a positive trend. This would seem to suggest that the market will continue to appreciate for the foreseeable future. The growth plot will be especially useful in determining if the market has peaked and we have already seen the greatest gains. In the real world, any signs of peaking would be the time to sell any high risk stocks that one owned.

Date	Cash	Stock Portfolio Value	Option Portfolio Value	Shorted Stock Portfolio Value	Account Value
6/17/2010	\$193.14	\$102,492.74	\$0.00	\$0.00	\$102,685.88
6/16/2010	\$193.14	\$102,459.09	\$0.00	\$0.00	\$102,652.23
6/15/2010	\$193.14	\$101,426.70	\$0.00	\$0.00	\$101,619.84
6/14/2010	\$193.14	\$99,033.32	\$0.00	\$0.00	\$99,226.46
6/13/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/12/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/11/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/10/2010	\$193.14	\$99,200.24	\$0.00	\$0.00	\$99,393.38
6/9/2010	\$193.14	\$95,648.42	\$0.00	\$0.00	\$95,841.56
6/8/2010	\$193.14	\$98,978.33	\$0.00	\$0.00	\$99,171.47

Table 7: Portfolio value throughout Week 2 (6/14/10 – 6/18/10)

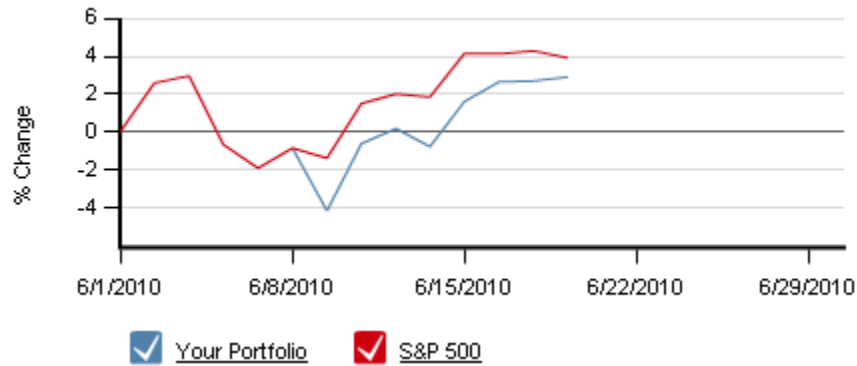


Figure 10: Graph of portfolio value vs. S&P 500 index value at the end of Week 2 (6/14/10-6/18/10)

3.3: Week 3 Data

This week yielded tremendously disappointing results as far as our stock portfolio was concerned. Our portfolio’s value went from a total gain of \$2984.54 to a total loss of \$2765.70, meaning that our initial investment of just under \$100,000 is now worth approximately \$97,000. Literally, each of our four stocks posted a significant loss and Apple was the only stock to still be worth more than what we had originally purchased the shares for.

Account Value (USD): \$97,556.75 Buying Power: \$46,847.00 Cash: \$5,053.85 Annual Return: -29.34 %								
Stock Portfolio								
Symbol	Description	Qty	Purchase Price	Current Price	Total Value	Today's Change	Total Gain/Loss	
Sell F	FORD MOTOR CO	2704	\$11.14	\$10.75	\$29,068.00	\$0.00(0.00 %)	-\$1,054.56 (-3.50 %)	
Sell AAPL	APPLE INC	119	\$253.24	\$266.70	\$31,737.30	\$0.00(0.00 %)	\$1,601.74 (5.32 %)	
Sell BP	BP ADR	271	\$35.83	\$27.02	\$7,322.42	\$0.00(0.00 %)	-\$2,387.51 (-24.59 %)	
Sell GOOG	GOOGLE INC A	61	\$487.85	\$472.68	\$28,833.48	\$0.00(0.00 %)	-\$925.37 (-3.11 %)	
Total:					\$96,961.20	\$0.00(0.00 %)	-\$2,765.70 (-2.77 %)	

Table 8: Portfolio information for Week 3 (6/21/10-6/25/10)

It was expected that Apple would continue to do well, with the release of the new iPhone (despite widely covered antennae problems) and continued good sales of the iPad. What possibly could have caused such a terrible week for the rest of our portfolio? A judge sided with Google and YouTube throwing out Viacom’s billion dollar lawsuit and Verizon and Google introduced

the Droid X, a phone to compete with the iPhone 4. While the CEO of Ford Europe projected a weak second quarter [30], Ford had plenty of news to buoy it: investment in a plant in Thailand, the governor of Missouri predicting passage of tax benefits, upgrades to the Mustang, and the release of the Ford fiesta. If stock prices moved on news alone, that would seem to be enough. Why Google and Ford did not perform well this week is not apparent.

BP suffered a setback when a Remotely Operated Vehicle crashed into the collection hood, but was able to recover quickly to the previous rate of oil capture [31], but the real villain in the dire fall in price was apparently related to fears that BP might have to issue additional shares to cover cleanup costs. News that BP had paid \$2.35 billion in cleanup so far also exerted a downward pull on stock prices, as did news of an incoming tropical storm [32]. The bond market reflected a fear of short-term default risk by exhibiting higher yield of bonds maturing sooner, an inversion of the usual relationship

The following graph and accompanying table show our overall portfolio value over the course of the simulation. It seems as though the portfolio's value peaked between June 15th and June 22nd, which is why, in accordance with Taleb's principles, we are re-evaluating our positions and resorting to different techniques in order to limit the damage to the overall value of the portfolio. If the investment simulator we are using would allow it, now might be exactly the time when a typical investor might consider buying on margin. A typical investor might want to make up lost ground by making a larger bet. In particular, we wish we could apply some leverage to our short bet on BP, because it seems like a fantastic one.

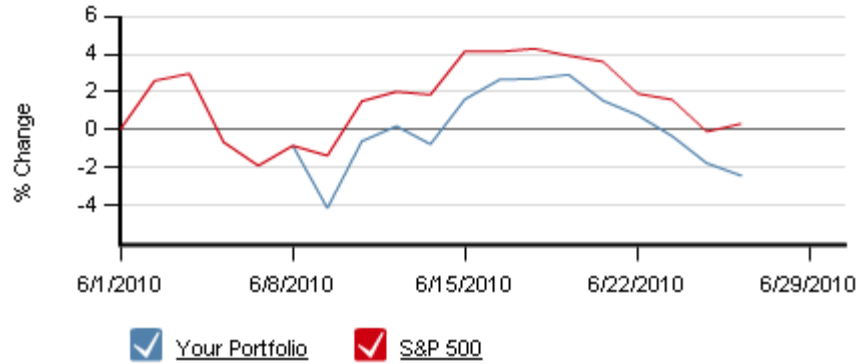


Figure 11: Portfolio Value vs. S&P 500 Index Over Week 3 (6/21/10 – 6/25/10)

Date	Cash	Stock Portfolio Value	Option Portfolio Value	Shorted Stock Portfolio Value	Account Value
6/25/2010	\$5,053.85	\$96,961.20	\$0.00	\$4,458.30	\$97,556.75
6/24/2010	\$5,053.85	\$97,929.76	\$0.00	\$4,742.10	\$98,241.51
6/23/2010	\$5,053.85	\$99,516.17	\$0.00	\$4,895.55	\$99,674.47
6/22/2010	\$5,053.85	\$100,618.04	\$0.00	\$4,897.20	\$100,774.69
6/21/2010	\$193.14	\$101,348.94	\$0.00	\$0.00	\$101,542.08
6/20/2010	\$193.14	\$102,711.44	\$0.00	\$0.00	\$102,904.58
6/19/2010	\$193.14	\$102,711.44	\$0.00	\$0.00	\$102,904.58
6/18/2010	\$193.14	\$102,711.44	\$0.00	\$0.00	\$102,904.58
6/17/2010	\$193.14	\$102,492.74	\$0.00	\$0.00	\$102,685.88
6/16/2010	\$193.14	\$102,459.09	\$0.00	\$0.00	\$102,652.23
6/15/2010	\$193.14	\$101,426.70	\$0.00	\$0.00	\$101,619.84
6/14/2010	\$193.14	\$99,033.32	\$0.00	\$0.00	\$99,226.46
6/13/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/12/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/11/2010	\$193.14	\$99,997.66	\$0.00	\$0.00	\$100,190.80
6/10/2010	\$193.14	\$99,200.24	\$0.00	\$0.00	\$99,393.38
6/9/2010	\$193.14	\$95,648.42	\$0.00	\$0.00	\$95,841.56
6/8/2010	\$193.14	\$98,978.33	\$0.00	\$0.00	\$99,171.47

Table 9: Portfolio value throughout Week 3 (6/21/10 – 6/25/10)

3.3.1 Short Selling

Since our current portfolio is obviously not having much success, we are going to resort to alternative tactics. First and foremost, we are going to use BP’s continuing fall to our advantage by short selling the stock. Short selling is a practice where the investor orders a set number of shares of a stock sold by their broker. The broker sells these shares and deposits the

funds from the sale in the investor's account. The catch is that the broker is only lending the shares to the investor and requires that the investor purchase the same number of shares of the same stock and returns them to the broker at a later date. The advantage of this method is that if the share prices plunge after the funds have been deposited in the investor's account, he/she can purchase the same number of shares for less money in order to "cover" the short sell, resulting in a profit. For example, suppose 100 shares of BP are sold by the broker for \$10/share and the sale amount of \$1000 is transferred to the investor's account. Shortly thereafter, BP's share prices fall to \$5/share, so the investor purchases 100 shares of BP at a price of \$500 and covers the short sell by returning the shares to the broker. Thus, the investor has made a profit of \$500 (\$1000 deposited - \$500 cover). Conversely, short selling also poses the risk of losing money if the share prices *increase* after the short sell has taken place. Using the same scenario as above, if BP's share prices increase to \$20/share, then the investor *loses* \$1000 (\$1000 deposited - \$2000 cover) if he/she decides to cover at that moment. It is difficult to decide when to cover because the share prices may continue to rise, meaning greater losses if the investor waits or the share prices may fall dramatically soon after, meaning that the investor unnecessarily loses money if he/she covers too early. Furthermore, share prices have no limit as far as the highest price they can attain goes, whereas they can only depreciate to \$0. What this means is that the maximum profit that an investor can make through short selling is 100% while there is no limit to how much he/she can lose. Finally, the stock market is designed around the fundamental principle that stock will appreciate, so by short selling, you are essentially betting *against* the entire market and its operational principles. Thus, not only are you undertaking a greater risk, but you are also frowned upon by fellow investors who feel that you are cheating the system by betting against the success of the market and driving the stock price down. Nevertheless, when done

properly, short-selling offers the potential of great rewards and considering the abysmal performance of our portfolio thus far, we feel that employing this technique might salvage our investment. . The following table summarizes this week’s short sell of BP stock (\$5000 worth of shares):

Shorted Stock Portfolio		Short Stock		Symbol Lookup		More	
Symbol	Description	Qty	Purchase Price	Current Price	Total Value	Today's Change	Total Gain/Loss
Cover BP	BP ADR	165	\$29.58	\$27.02	\$4,458.30	\$0.00(0.00 %)	\$422.40 (8.65 %)
Total:					\$4,458.30	\$0.00(0.00 %)	\$422.40 (8.65 %)

Table 10: BP Short Sell Data for Week 3 (6/21/10-6/25/10)

So, we cautiously used the short selling approach this week by ordering \$5,000 worth of BP shares and as expected, share prices fell even further meaning that if we were to cover the stock we would have made \$422.40. The reason why we didn’t cover the stock is because we are certain that we can net a greater profit by allowing BP’s share prices to fall even further before we cover.

3.3.2 Hedging on Apple

Similarly, we are going to take a small short position on Apple stock in the coming week, which seems ludicrous. However, the reason for this decision is that Apple’s new iPhone 4 has been reported to have many issues (expected since this is a brand-new model that will have some teething problems). We fully expect Apple’s share prices to fall in the coming week due to the widespread reports of problems. Since Apple has a reputation for quickly rectifying such issues, we are planning on using options to predict that Apple stock will fall on the very short term (by July 2nd) whereas we are going to short sell an additional \$15,000 worth of BP stock taking a

comparatively more long term position short position. In contrast to the BP short sale, where potential loss is theoretically unlimited (BP's shares could climb quite a lot), the options maneuver allows us to have a limited risk. We can lose, at most, the premium. This is a good thing, because predicting Apples fall seems a lot more contingent than BP's, and falls into the category of a hedge. We aim to guard against loss in value of our Apple holdings by predicting and profiting from the dip, and compensating for any loss in value. More sophisticated investors would have worked out the predicted trends before and hedged perfectly to compensate for potential losses.

As mentioned above, one can take a bearish position on a stock by either selling a call option or buying a put option. The investment simulator we are using does not allow one to write options, so we had to buy a long put. The put market at the time of planning our purchase allowed for July 2nd and July 17th as the soonest dates of expiration. A wide variety of strike prices is available, with a correspondingly wide variety of premiums. With a put option, a higher strike price means a higher premium. In ignorance of option pricing, we decided to purchase about \$2500 worth of put options with a premium of \$24.05 each and a strike price of \$290. This turned out to be just one option, controlling 100 shares of the underlying security.

3.3.3 Losing Google, New Ventures

As it stands now, we have lost \$2710.15 or in other words, 2.72% of our original investment of \$99726.90. In addition to the short selling technique, we are looking to sell our Google shares. Given that Google is engaged in a fight to the death with one of our other investments, having money in both seems like a failure of diversification, as the fortunes of the two companies are linked. A gain on Apple's side, because of a new smart-phone perhaps, will probably also entail a loss on Google's side due to projected loss of market share; they are not truly independent. Over the last month, their performance has been mirrored.

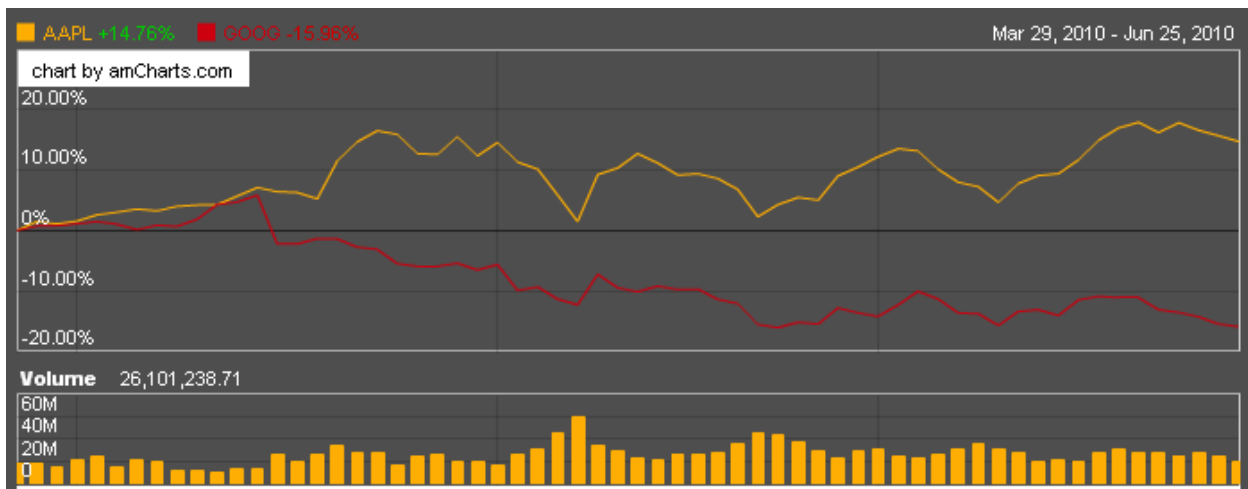


Figure 12: Google vs. Apple, Percent Change in Value, Mar. 29 - June 25

Given the lackluster performance of other more conventional stock picks and the short time left for the simulation, riskier investments are needed. A booming and volatile industry is ideal, ideally one not yet the domain of established interests. Small-to-midcap biotechnology fits the bill exactly [33]. As seen in the graph below, money is pouring into biotech. Even more ideally, it is estimated by InvestBio that only about 40 analysts in Wall Street firms cover this segment of the biotech market.

Small biotechnology companies can have promising drug therapies, but require the funding

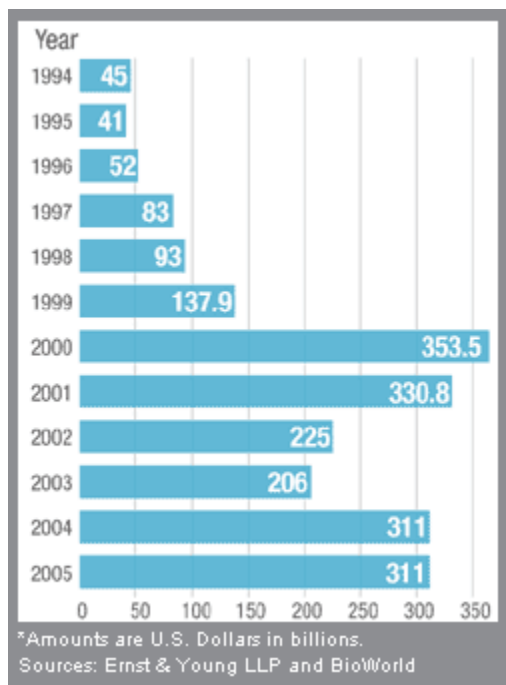


Figure 13: Biotechnology Market Capitalization, 1994-2005

necessary to continue research and development on these therapies. In this sense, biotech startups are following steps similar to many other startups: there is an initial capitalization through an IPO, a period of varying burn rate without profit while developing the drug, and eventual entrance into profitability after it is cleared for human use by the U.S. Food and Drug Administration after medical trials. Wise investment in

these early on could yield good returns.

It's worth noting how closely biotech investments depend upon actions of the FDA and the results of medical trials. This avenue of information is absolutely essential to investing well. We are actively scanning websites such as biospace.com (biotech news) to seek out and identify potential short term investment candidates. As with any other "hot industry" there are plenty of sites and newsletters out there offering "great tips" for a fee.

3.3.4 Biotechnology Firm Selections

After extensive research, we have identified four potential candidates that could show significant growth in the coming week. These companies are Gilead Sciences, Inc., Roche Holdings, Vertex Pharmaceuticals, Inc., and Regulus Therapeutics, Inc. All of these companies have either bought out a competitor, been acquired by a competitor, or have drug protocols that have yielded promising results in the past week.

The criteria for selection have changed drastically. A slow-moving large cap stock is no longer ideal for short-term returns. Further, much less information is available. Many of these companies are joint ventures between publicly traded companies, so the numbers we have been relying upon do not apply. The fundamental difference is that the intended scale of investment is shorter. We are only concerned with companies that could have a large windfall in the next two weeks. Long term performance is no longer a predictor; we are looking for immediate term benefits. With that in mind, the research focused on current events.

Gilead Sciences is headquartered in Foster City, California with operations in North America, Europe, and Australia. They just recently (6/25/10) signed an agreement with CGI Pharmaceuticals, Inc., finalizing a \$120 million dollar buy out of the latter. One of the few companies under consideration that is not a joint venture; our measurements are available:

Company	Capitalization (in billions USD)	Positive Trend (over last 6 months)	P/E Ratio	PEG Ratio	Profit Margin
Gilead Sciences Inc.	31.03	Yes	11.18	0.72	N/A

Table 11: Table showing investment criteria as applicable to Gilead Sciences, Inc.

The picture that emerges is one of a solid long-term investment. This would have been a good buy by our original standards. It remains to be seen if this is still true under new criteria.

Gilead’s Executive Vice President, Research and Development, and Chief Scientific Officer Norbert W. Bischofberger released the statement: “The acquisition of CGI represents a unique opportunity to expand our research efforts in an interesting and promising area of drug discovery. CGI has established itself in the area of protein kinase biology and small molecule

discovery, and the company's scientific leadership and expertise represents a strong strategic fit with Gilead's existing research organization. We look forward to advancing compounds in CGI's portfolio toward clinical development." [34]

However, we have decided not to purchase Gilead stock because it seems that they are also downsizing, which is a troubling sign. In a report by the Triangle Business Journal, "Gilead Sciences (Nasdaq: GILD) will close its Durham office by year's end in a move affecting 150 workers, as the Foster City, Calif.-based bio-sciences company consolidates in anti-viral research and development efforts." [35]

Genentech, Inc. had been operating for nearly 30 years when it was acquired in 2009 by Roche Holdings. It specializes in the discovery, testing, and manufacture of drugs that are used to treat serious or life-threatening ailments. The latest drug under the Genentech brand has been Lucentis®, has recently been approved by the FDA in order to treat the effects of Retinal Vein Occlusion (RVO).

RVO is essentially the loss of blood flow to the retinal vein and results in the swelling and hemorrhaging of the retina, which can result in permanent loss of vision. The condition affects over 1 million people in the United States alone. Lucentis had tremendous success during clinical trials: "In wet AMD clinical trials, Lucentis administered monthly demonstrated an improvement in vision of three lines or more on the study eye chart in up to 41 percent of patients at two years. Nearly all patients (90 percent) in those trials treated monthly with Lucentis maintained vision." [36]

We have decided to invest in Roche because of the overwhelming success of its drug in clinical trials and the recent approval by the FDA. Gaining approval of the FDA and releasing a

drug to market is no easy feat, so we are quite confident that Roche will increase in value during the coming week.

Vertex Pharmaceuticals, Inc. is a biotechnology company located in Cambridge, Massachusetts. Its research focuses on finding small molecule drugs to treat viral diseases, inflammation, autoimmune diseases, cancer, pain, and bacterial infection. One of Vertex's key discoveries (in conjunction with GlaxoSmithKline) was the HIV protease inhibitor, Lexiva.

Vertex has been developing a drug to treat Hepatitis C called Telaprevir®. According to a news report on 5/26/10 by Reuters, "A hepatitis C treatment being developed by Vertex Pharmaceuticals, Inc. led to a 75 percent cure rate in a pivotal trial of previously untreated patients, the company said on Tuesday." [37] Hepatitis C is a viral infection of the liver that is transmitted through blood contact such as contaminated needles. It can result in liver failure, liver cancer, and even death. Hepatitis C has infected upwards of 270 million people (equivalent to the population of the United States) throughout the world.

Considering the impact that Vertex's drug, Telaprevir®, could have on the millions of people suffering from Hepatitis C, it is our feeling that they "have a winner" so to speak. A 75% cure rate is nothing short of remarkable and is sure to cause Vertex's company to increase in value.

Regulus Therapeutics, Inc. is a joint venture of Alnylam Pharmaceuticals of Cambridge, Massachusetts and Isis Pharmaceuticals of Carlsbad, California that specializes in the development of drugs that are based on microRNAs. Their research and development focuses on Hepatitis C, cardiovascular disease, fibrosis, oncology (cancer), immuno-inflammatory diseases, and metabolic diseases.

On June 22, 2010, Regulus officially partnered with Sanofi-Aventis, a globally recognized pharmaceutical company: “Regulus Therapeutics Inc. and Sanofi-Aventis (EURONEXT: SAN and NYSE: SNY) announced today that they have entered into a global, strategic alliance to discover, develop, and commercialize microRNA therapeutics. The alliance represents the largest microRNA partnership formed to date, valued at potentially over \$750 million, and includes a \$25 million upfront fee, a \$10 million future equity investment subject to mutual agreement on company valuation, and annual research support for three years with the option to extend two additional years. The alliance will initially focus on the therapeutic area of fibrosis. Regulus and Sanofi-Aventis will collaborate on up to four microRNA targets, including Regulus’ lead fibrosis program targeting microRNA-21. Sanofi-Aventis also receives an option for a broader technology alliance that provides Regulus certain rights to participate in development and commercialization of resulting products. If exercised, this three-year option is worth an additional \$50 million to Regulus.” [38]

Although the partnership between Regulus and Sanofi-Aventis is a significant development with a high potential for growth, we are looking to generate good-sized profits within the next 7-10 days and a newfound partnership is not likely to give us this result. Had we been seeking to invest in the long term, investing in Regulus would most certainly have been a wise decision. To do so, we would have had to invest in the two firms that have stakes in it, with an inherent diversification.

In conclusion, we will be selling our Google shares and evenly investing the funds from this transaction between Genentech, Inc. and Vertex Pharmaceuticals, Inc. We are both of the impression that this should yield much better results than Google did over the past 3 weeks and look forward to seeing our investment grow. These investments are incrementally more risky

than those made at first. Where the first round of purchases pursued “large-cap but growing” in established industries, these two investments are “mid-cap and volatile” in a booming industry. This profound shift has been dictated by time and emotion; a failing portfolio and a set time limit prompt drastic action.

3.4: Week 4 Data

The performance of our portfolio in Week Four was somewhat of a disaster. We at least had the solace of knowing that many other investors shared our pain. “U.S. Stocks Drop as Dow Posts Longest Losing Streak Since 2008,” read a headline from Bloomberg BusinessWeek on July 3rd. As can be seen in the following table, our final portfolio value is \$93,196.26 or exactly 4% lower than our initial investment.

Stock Portfolio		Trade Stock	Symbol Lookup	More			
Symbol	Description	Qty	Purchase Price	Current Price	Total Value	Today's Change	Total Gain/Loss
Sell F	FORD MOTOR CO	2704	\$11.14	\$10.28	\$27,797.12	\$0.00(0.00 %)	-\$2,325.44 (-7.72 %)
Sell AAPL	APPLE INC	119	\$253.24	\$246.94	\$29,385.86	\$0.00(0.00 %)	-\$749.70 (-2.49 %)
Sell VRTX	VERTEX	419	\$34.36	\$32.22	\$13,500.18	\$0.00(0.00 %)	-\$896.66 (-6.23 %)
Sell RHHBY	ROCHE HLDG LTD SPONS	406	\$35.45	\$34.50	\$14,007.00	\$0.00(0.00 %)	-\$385.70 (-2.68 %)
Sell XOM	EXXONMOBIL	505	\$57.29	\$56.57	\$28,567.85	\$0.00(0.00 %)	-\$362.59 (-1.25 %)
Total:					\$113,258.01	\$0.00(0.00 %)	-\$4,720.09 (-4.00 %)

Table 12: Portfolio value throughout Week 4 (6/28/10 – 7/2/10)

Needless to say, this was quite disappointing as we had high hopes that our biotechnology stocks and ExxonMobil would be quite profitable this week. Major news for BP was the rumors of acquisition of some of its assets by various buyers. One widely circulated report starting the rumor machine was JP Morgan analyst Fred Lucas’ estimation that BP was

62% undervalued, concluding that “the market has lost sight of the intrinsic value that is resident in an asset-rich company like BP” [39]. This supports the original idea behind the BP purchase that the stock was undervalued, and had hit bottom. Unfortunately, given the amount of time remaining, the portfolio would probably not see this acquisition happen. Mergers and acquisitions take time, and the term is almost over. With that in mind, all interest in BP (bearish or bullish) has been discarded. The short option lost value on news of the rumors, but could plunge further down on any news from the cleanup (such as BP’s response to its having been burning endangered sea turtles alive [40]). In short, predicting the value of BP’s stock in the short term is a loser’s game for our portfolio. We have thus sold the BP stock and bought Exxon, in hopes of seeing some short term gain. Goldman had rated Exxon at a price target of around \$65 on the 28th of June. Disappointment followed as Exxon instead fell to \$56.57.

Ford has not been performing well for this portfolio, but better times may be ahead. Alan Mulally issued a statement that it was reducing its debt by \$4 billion, which has been interpreted by Wall Street Journal analysts as “a sign the auto maker remains confident in its own turnaround despite a softening car market in the U.S.,” which placed the stock on it’s Hot Stock List on June 30th. In less encouraging news, the tax package projected to go through in Missouri has been trapped “in legislative limbo, imperiling its chances for passage” [41].

Financial bloggers had given reason to hope for the performance of the biotechnology investments made. The volume of call options can be a benchmark for improvement, and the options volume of Vertex was trading about 7 times higher in volume than the daily average, signaling traders forecasting a rise in stock price [42]. Technical analysts had rated Vertex highly only a few days earlier, on June 30th, when the stock was listed as one of the top five in the Healthcare sector by the “Relative Performance” index [43]. Roche Holding entered an

agreement with IBM on July 1st to develop a novel DNA sequencing technology [44], a British healthcare watchdog recommended that Roche's arthritis drug be covered by the NHS [45], and second stage studies supported Avastin for increasing survival of ovarian cancer [46]. These positive developments did not affect stock price as hoped, however, with further losses over the week.

3.4.1: The Apple Hedge

As mentioned earlier, we went long on a put option for Apple on a hunch that the backlash from the antenna issue would become worse and negatively impact Apple's stock. Other issues also became apparent, first of which a "frequent fail[ure]" of the proximity sensor in the phone that is supposed to detect the user's face and disable the touch pad [47]. Also distressing for holders of Apple stock, an issue surfaced last week with a yellowing of the display screens. Apparently, a bonding agent used on the screens might have not been given enough time to cure properly, causing yellowing [48]. The issue seems less severe than it could have been, however, as the compound eventually does cure and the yellowing issue disappears. The issue has been framed as a byproduct of the massive demand for iPhones necessitating a quickened manufacturing process.

The option hedge played last week paid off very well, with two major caveats. One being that it was not calculated to precisely hedge our bets, the other being that there was some potential profit that wasn't made on account of the timing of the sale. The option was purchased at noon on June 28th, controlling 100 shares of AAPL (less than our holding of 119 shares), at a price of \$2,346.74. The underlying stock, AAPL, was trading at \$267.73. The intrinsic value of the option, therefore (the difference between its strike price of \$290 and Apple stock's \$267.73) was about \$2,227. The stock would have to fall another \$1.20 for the option to break even, and

any further falling would be profit. The option was sold at 3pm on the 30th, when the option was worth \$3,363.26, and the underlying stock was trading at 255.16. We realized a profit then, of \$1016.52, a 43% return on investment. Our shares in the underlying stock, however, had lost \$1495.83. We see then, that this was not a full hedge. The fall in price from the stock outweighed the gains made on the option. If the stock had risen instead, the total loss would have been limited to the \$2,346.74 premium invested, and the profits from our investment in Apple would have outweighed it handily. In short, the way we hedged reflected (unconsciously) a feeling that Apple had a greater chance of rising than falling. The decision to sell at the moment we did, too, was driven by this notion as well. It was felt that Apple's depressed value could not be maintained with a new product on the market, and it was feared the option would eventually lose value. We are, after all, long on Apple.

This may have been a mistake, as Apple's stock (along with the stock of pretty much everything else) has continued to fall. The reasons given by different analysts for this recent downturn are legion, from the doomsday predictions of Elliot Wave theorist Robert Prechter (who predicts an epic downturn and a massive depression) to the more conventional "fear of a double dip recession" confidence quavers of more mainstream analysts.

3.4.2: Missing the Tesla IPO Boat

The Tesla Motor Company has long been on the radar of any aspiring mechanical engineering student. An electric car that does zero to sixty in 3.9 seconds is a very conspicuous entry in the sports car market, and gorgeous styling doesn't hurt. The company going public provided a great opportunity to have these interests intersect. The initial offering price was only \$17. Unfortunately, while we were aware of the IPO on Tuesday, shares were only purchased for \$25.79 at 10am on Wednesday, and sold later that same day at 3pm for \$25.82 realizing the boat

had been missed. The value peaked at \$30.18 less than an hour and a half after purchase. Massive profits could have been realized with earlier action, but massive losses could have resulted with a slower realization that the stock was over-valued for the entirety of Wednesday. A further opportunity came with the stock settling into what is presumably a true value: if a good guess for TSLA's eventual value could have been made in time, a potential short sell, short put, or long call could have been made to capitalize on its reversion to that value. It is possible that the reversion was so sudden because of realizations on the part of investors that Tesla hasn't turned a profit since its beginnings in 2003, and that its \$109,000 sole product might not weather economic recession well.



Figure 14: First Days of Tesla IPO and Actions

Chapter 4: Results

During the four week period, we made buy and sell transactions totaling \$362,439.20. This is an astounding figure. Over 28 days, the turnover was approximately 362%. When projected over the course of a year by calculating daily turnover and multiplying by 265, the figure becomes 4724.65%. Clearly this portfolio represents a hyper-active trading style, dwarfing the average equity mutual fund turnover (100%) by a factor of 47. Expenses due to commissions, perhaps counter intuitively, were quite low in comparison to portfolio value. The commissions on this massive amount of trading only ate up about 0.33% of our starting capital. Remembering Bogle's rule of thumb that 100% turnover eats 1%, our expenses have been astoundingly low.

Date	Trade Type	Symbol	Quantity	Target Price	Price	Commission	Total Cash Value	Account Value
7/1/2010 10:05 AM	Cover Stock: Cover at Stop	BP	720	\$29.68	\$29.79	\$29.99	\$21,478.79	\$93,196.26
6/30/2010 3:57 PM	Stock: Buy at Market	XOM	505		\$57.29	\$19.99	\$28,950.43	\$93,923.83
6/30/2010 3:18 PM	Stock: Sell at Market	TSLA	1068		\$25.82	\$19.99	\$27,558.87	\$94,861.74
6/30/2010 2:39 PM	Option: Sell to Close at Market	AAPL1002S290	1		\$33.85	\$21.74	\$3,363.26	\$94,723.90
6/30/2010 9:57 AM	Stock: Buy at Market Open	TSLA	1068		\$25.79	\$19.99	\$27,563.71	\$94,113.48
6/30/2010 9:57 AM	Stock: Sell at Market Open	BP	271		\$28.73	\$19.99	\$7,765.84	\$94,190.38
6/28/2010 12:01 PM	Option: Buy to Open at Market	AAPL1002S290	1		\$23.25	\$21.74	\$2,346.74	\$97,377.16
6/28/2010 10:59 AM	Stock: Buy at Market	RHHBY	406		\$35.45	\$19.99	\$14,412.69	\$96,845.47
6/28/2010 10:56 AM	Stock: Buy at Market	VRTX	419		\$34.36	\$19.99	\$14,416.83	\$97,000.28
6/28/2010 10:03 AM	Stock: Sell at Market Open	GOOG	61		\$472.59	\$19.99	\$28,808.00	\$97,627.19
6/28/2010 9:59 AM	Short Stock: Short at Market Open	BP	555		\$27.65	\$19.99	\$15,325.76	\$97,250.88
6/22/2010 10:05 AM	Short Stock: Short at Market Open	BP	165		\$29.58	\$19.99	\$4,860.71	\$101,689.51
6/8/2010 9:57 AM	Stock: Buy at Market Open	GOOG	61		\$487.85	\$19.99	\$29,778.84	\$99,929.85
6/8/2010 9:57 AM	Stock: Buy at Market Open	BP	271		\$35.83	\$19.99	\$9,729.92	\$99,955.26
6/8/2010 9:57 AM	Stock: Buy at Market Open	AAPL	119		\$253.24	\$19.99	\$30,155.55	\$99,980.01
6/8/2010 9:57 AM	Stock: Buy at Market Open	E	2704		\$11.14	\$19.99	\$30,142.55	\$100,000.00

Total Transactions: 16

Table 13: Table of transaction history of the full four week simulation period

With the exception of the virtual break-even of Tesla, every single regular stock transaction became a loss (totaling \$7,544.02). BP and Ford made up 56.3% of all money lost to normal stock trades, despite being only 39.8% of the initial portfolio. The sole glimmers of hope were special transactions. The 5.7% returned on short-selling BP brought a 5.7% return as shown above, which did a lot to offset its stock's terrible performance, representing a "short term drop, long term rise" bet that paid off to some degree. The Apple hedge more than offset any losses from the decline in Apple's value, but there is no reason to believe that the dive that Apple's stock price took had anything to do with the iPhone problems whose existence we predicted. It seems much more likely that Apple dived for whatever reasons the entire market did. The utility of options in hedging was demonstrated, but a lesson about the unpredictability of the markets was taught as well.

After examining a graph of the overall performance of our portfolio, it looks as though our portfolio's value peaked at 2.9% on June 18. Thus, it would have been a wise decision to sell our holdings at that point because we would have made almost a \$3000 profit. Unfortunately, our decision to wait and let the market play out was a costly one. One could take away from this experience that investing in the stock market over the short term, it is best to buy/sell small and earn small rather than buying large amounts of stock, holding on to them for a long period of time, and then ultimately watching them lose quite a large percentage of their value. Conversely, it is also possible to take from this that the human tendency while watching stocks is to sell them on the downtick, which is precisely contrary to one's financial interest. Finally, over the period of the investment simulation, the S&P500's value fell by 3.97%. Our portfolio fell by 8.03% by comparison, lagging the market significantly. Annualized return for our portfolio would be -63.4%, a dismal result by any measure.



Figure 15: Portfolio value vs. S&P 500 index value throughout entire simulation with peak

Chapter 5: Conclusions & Discussion

5.1 Diversification

*But divide your investments among many places,
for you do not know what risks might lie ahead.*

- *Ecclesiastes 11:2 (NLT)*

In the rush to understand the investing world well enough to pick some stocks, some key conventional wisdom on portfolio construction was under-appreciated. Specifically, we have reason to believe our portfolio was under-diversified to some degree. With the phenomenal turnover rate, we might have possessed a wide variety of stocks at one time or another, but holdings at any given time were restricted to only five or six stocks. Part of this was a bias towards smaller decisions on the basis of insufficient time to research many options, but even arbitrary purchases of stocks on the major indices might have helped us reduce the volatility shown by our returns. Studies have shown that the difference in standard deviation of returns between one stock and a portfolio of ten is a factor of two. However, the reduction in returns variability between the four to six stocks we had and the perhaps twenty we could have ginned up would not have been anything close to that. The same study places a four stock portfolio at 27% standard yearly deviation and a twenty stock portfolio at 22%. Clearly, the benefits of diversification further than we had put together wasn't the sole cause of our failure.

5.2 Conclusion

If this portfolio were intended to stand in for an actively managed equity mutual fund, there would be points of wide divergence from the intended attributes. To begin with, turnover as experienced here would be much smaller. The turnover in our portfolio is more representative of

an insanely active individual investor. Another divergence would be the expenses experienced. A fund would have had employee salaries to pay among other overhead. Even so, our fund might not have been totally inapplicable to the hypothesis.

It is clear that this particular actively managed portfolio performed poorly. The question remains as to what this says about active management in general, and specifically what it says with regards to the hypothesis of the experiment overall. This might have just been a bad time to try this experiment. If both the index equity mutual funds and the rest get shelled, there's no support or refutation of the hypothesis.

Only a handful of mutual funds finished this quarter with any profit at all, index or not, and those that did posted miserable gains. Three cited by a recent MarketWatch article as good examples of that small group are Montegale Informed Investor Growth, +2.7%, Stadion Managed Portfolio Fund, +0.5%, and Wasatch Heritage Value Fund +0.2%. Large-cap stock funds fell 12% on average, mid-cap by 9.7%, and small-cap by 9.1% [49]. Our portfolio's initial focus on large-cap stocks as being risk-resistant was a bad one. Fortunately, we did not stick with that set of criteria long.

So if there is plenty of evidence for active managements losses in this climate, what about the intended hero of this exercise, the index fund? The simplest statement is this: the fund of mentor's making, the Vanguard Total Stock Market Index, fell by 11.3%. This may be partially because the index fund weights its investments by capitalization, having a heavier emphasis on bigger funds, which it seems did not weather this downturn well. "Most people never really got back into equity investing" after the 2008 meltdown, said Morris Mark, president of investment manager Mark Asset Management. "The economy is getting better very slowly, but a lot of

roadblocks have emerged [50].” If one wanted to find a profit in managed funds, only precious metals or bear-strategy funds could have sufficed.

The “risk-free” alternative to this entire stock-picking exercise would have been much simpler. On the day of June 7th, we would have purchased 100 28-day Treasury bills. They would have carried a 0.1% coupon discount [51], meaning each would be bought for \$999.92. After 28 days later, we would have made \$8 in profit, which would have been about \$8,042.29 more than was actually made.

The part of the hypothesis that seems most challenged superficially by this set of circumstances is the underlying assumption that the stock market as a whole will continue to reflect the creation of value by American industry. Despite this down market, this still seems true. It is not as if all of these large-cap companies just stopped selling products (regardless of the analyst talk of reduced consumer spending); there is still value being created every day. The same factors that cause stock prices to fluctuate can cause the entire market to temporarily trend in one direction or the other. While this experiment might not be the strongest support for the hypothesis, it is certainly not a refutation. The down market does not affect the logic that the best way to capture the market return (however bad it might be) is to hold as much of the market as possible, and that the market will eventually recover. When it *does* recover, it is still likely that an index fund will be the most reliable to profit from it. It might be best to focus on bond index funds for now, however.

5.4 Investment Emotions and the Daily Grind

A key lesson to take away from this experience is that the prudent investor must not dwell on the results of one day's trading. Many times over the course of the simulation, we were either elated or severely dismayed at the performance of one or more of our stocks, only to see the opposite result happen by the end of the week. A case in point is the performance of Apple; at the end of week 3, we had made a profit of \$1601.74 and we were extraordinarily pleased with this result. Yet, by the end of week 4 not only had we totally lost this profit, but we also had a deficit of \$749.70. The moral of the story is that you cannot be encouraged or discouraged by the performance of a stock over a limited timeframe. Due to the level of volatility in the market, the value of a particular stock can change drastically throughout the day. An investor who is constantly paying attention to only the instantaneous value of his/her holdings, will likely suffer a nervous breakdown from the sheer emotion of seeing share values go up and down incessantly. Indeed, investment emotions can also spur action against one's best interest, or the haphazard adoption of new trading methods without careful thought. Key examples here are the changes in stock strategy documented throughout this project. These would not have occurred without emotional reaction to losses in the stock market driving them.

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